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## ROYAL GARDENS, KEW.

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### BULLETIN

OF

## MISCELLANEOUS INFORMATION.

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No. 39.]

MARCH.

[1890.

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### CXXXIV.—INDIAN YELLOW.

Indian Yellow, or Purree, is thus described in the ordinary books of reference:—"It is a colouring matter highly esteemed by artists. It is exported from the East Indies in masses of three or four ounces in weight, which are of a dark brown colour externally, but of a bright orange yellow in the interior. Nothing certain is known regarding its origin, but it is generally believed to be a urinary sediment of the camel or buffalo, after the animal has fed on decayed and yellow mango leaves. Its odour is peculiar, and resembles that of castoreum."

In 1883, Dr. Hugo Muller, F.R.S., applied to Kew for information on the subject on behalf of Professor Græbe, the well-known chemist, who contemplated a thorough chemical examination of the substance.

From the following correspondence it will be seen that its origin was completely cleared up.

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L O N D O N :

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1890.

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## ROYAL GARDENS, KEW, to INDIA OFFICE.

SIR,

Royal Gardens, Kew, January 31, 1883.

I AM desired by Sir Joseph Hooker to inform you that inquiries have arisen with regard to the exact origin of the important pigment known as Purree or Indian Yellow. This, according to the authorities, is "believed to be a urinary sediment of the camel or buffalo after the animal has been fed on decayed and yellow mango leaves." Chemically it is known to consist of the magnesian salts of an acid termed purreic or euxanthic acid. But as it contains no nitrogen, the traditional account of its source appears improbable.

It seems likely, therefore, that it is a substance of vegetable origin, and in this case inquiry through the proper channels ought to elicit some authentic information about it. I may mention that various papers which have been transmitted to this establishment in reference to Indian dyes do not appear to contain any reference to it.

Sir Joseph Hooker would, therefore, feel obliged if you would draw the attention of the Government of India to the matter.

I am, &amp;c.

(Signed) W. T. THISELTON DYER.

Sir Louis Mallet, C.B.

## INDIA OFFICE to ROYAL GARDENS, KEW.

SIR,

India Office, S.W., March 19, 1883.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 31st ultimo, relative to Purree or Indian Yellow. In reply I am to request you to inform Sir Joseph Hooker that a copy of your letter has been sent to the Government of India for such action as they may find they can take in tracing this important pigment to its origin. Sir George Birdwood has stated that in the Bombay bazaars Purree is said to come from China, and Sir Joseph Hooker may, therefore, be disposed to make inquiries concerning its sources also through the Foreign Office.

I am, &amp;c.

(Signed) JOHN K. CROSS.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.

## INDIA OFFICE to ROYAL GARDENS, KEW.

SIR,

India Office, November 17, 1883.

IN continuation of my letter of the 19th March last, I am directed by the Secretary of State for India in Council to transmit to you, for Sir Joseph Hooker's information, the accompanying copy of a report on the production of Purree or Indian Yellow, received from the Government of India.

The samples of Purree mentioned in the report have, it is understood, been sent to Sir Joseph Hooker direct.

I am, &amp;c.

(Signed) J. A. GODLEY.

W. T. Thiselton Dyer, Esq., C.M.G., F.R.S.



[ENCLOSURE.]

1883.

GOVERNMENT OF INDIA.

REVENUE AND AGRICULTURAL DEPARTMENT.

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 AGRICULTURE.
 

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 Note on Piuri or "Indian Yellow."
 

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Piuri is a yellow dye used chiefly in painting walls of houses, doors, and railings. It is seldom used for dyeing cloth owing to its bad smell. It is derived from two sources:—

- (1.) Of mineral origin, imported from London.
- (2.) Of animal origin, manufactured at Monghyr, a town in Bengal.

Sir Joseph Hooker has asked for information about the latter.

By inquiries in Calcutta I found that Piuri is made at Monghyr from the urine of cows fed with mango leaves. To substantiate the truth of this statement I went to Monghyr, and there found that a sect of gwalas (milkmen), residing at a place called Mirzapur, in the suburbs of the town, are the only people who manufacture the substance. They feed the cows solely with mango leaves and water, which increases the bile pigment and imparts to the urine a bright yellow colour. It is said that cows thus fed die within two years, but the Piuri manufacturers assured me that this statement is wrong; and, indeed, I myself saw cows six or seven years old from which Piuri has been obtained during the last four years. The cows, however, looked very unhealthy, and the manufacturers of Piuri told me that to keep up the strength of the animal they now and then allow her grass and other fodder besides the mango leaf, but a mixed food reduces the proportion of the colouring principle in the urine. Owing to the injurious effect which the treatment necessary for the manufacture of Piuri has on the cows, the occupation of making Piuri is confined to a very small number of people, who for this reason are looked down upon by their fellow caste-men. I am told that in no other part of the country is the manufacture of Piuri carried on. The cows treated with mango leaves are made to pass urine three or four times a day by having the urinary organ slightly rubbed with the hand, and they are so habituated to this process that they have become incapable of passing water of their own accord. The urine is collected during the whole day in small earthen pots, and in the evening put over the fire in an earthen vessel. The heat causes the yellow principle to precipitate, separating it from the watery portion. It is then strained with a small piece of cloth; the sediment is made into a ball, and dried first on charcoal fire and then in the sun, when it is ready for the market. The merchants (chiefly Marwaries), who advance money to the milkmen for the purpose, purchase the stuff at Re. 1 (1s. 8d.) per lb., and export it to Calcutta on the one side and Patna on the other. The price of the imported (mineral) Piuri is only 4d. per lb. The animal Piuri is of an exceedingly bright colour, and is therefore considered very superior to the mineral Piuri. The high price of the animal Piuri is probably owing to the deterioration of the live stock consequent on the manufacture of the article and the cost of procuring mango leaves, which are sold at

the rate of Rs. 2 for the produce of a middle-sized tree, say 30 feet high. An average cow passes about 3 quarts of urine a day, which yields about 2 ozs. of Piuri. The animal supply is said to be about 100 to 150 cwts.; but this seems to be an over-estimate, considering the small number of cows employed for the purpose.

I myself saw mango leaves lying before the cows, the collection of urine, and the manufacture of Piuri. So the real source of this kind of Piuri is now beyond any doubt whatever.

I have sent to Sir Joseph Hooker, direct—

- (1.) The mineral Piuri brought to Calcutta from London.
- (2.) Monghyr Piuri purchased at Calcutta.
- (3.) Monghyr Piuri purchased from the manufacturers.
- (4.) A bottle of urine from which the Piuri is obtained.
- (5.) An earthen pot in which the urine is collected.
- (6.) A quantity of mango leaves.

(Signed) T. N. MUKHARJI.

The 27th August 1883.

In the Geneva "Archives des Sciences Physiques et Naturelles" for December 1889, Professor Græbe has given the results of his investigations. So much of the article as deals with Indian Yellow itself is translated below.

"The yellow colouring matter which bears the name of Indian Yellow, or Piuri (Purree), has attracted, ever since it first became known in Europe, the interest of chemists and physiologists. The views as to its origin have been very various. Some have supposed it to be a deposit from the urine of the camel, elephant, or buffalo, or an intestinal concretion; by others it has been regarded as of vegetable origin."

Professor Græbe then describes the result of the inquiries set on foot by Dr. Hugo Muller. He continues:—

"Piuri occurs in rounded masses, weighing 80 to 120 grammes, of which the interior has a fine yellow colour, while the exterior is brown or greenish. The odour is very characteristic, and recalls that of castoreum. The analysis of the inner portion gives the following composition:—

Euxanthic acid	-	-	-	-	51.0
Magnesium	-	-	-	-	4.2
Calcium	-	-	-	-	3.4
Silica and aluminae	-	-	-	-	1.5
Water and volatile substances	-	-	-	-	39.0
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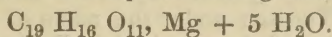
"In order to prepare the different qualities of Indian Yellow which are employed in water-colour painting, the unrefined product is submitted to a series of washings. The best brands of Indian Yellow are those richest in euxanthic acid and magnesia, and which contain but little lime. In the commonest and cheapest quality, besides the acid already mentioned, euxanthone, one of the products of its decomposition, also occurs in large quantity. This substance must be derived from the brown or green portions which have undergone change. Lefranc and Co., of Paris, prepare seven different qualities of Indian Yellow, which bear the brands A to G. The brand A is the best, and costs 300 francs the kilogramme; C costs 200; D, 160; and G 50 to 60 francs.



“ The following analysis illustrates what has been said above :—

—	A.	B.	C.	D.	G.
Euxanthinic acid -	72·3	70·9	64·3	59·3	33·34
Euxanthone -	0	1·12	2·80	7·4	33
Magnesium -	5·35	4·88	4·85	4·60	3·70
Calcium - -	1·75	2·43	2·61	3·33	3·70

“ The euxanthinic acid always occurs in combination as a salt, and the quality A approaches in composition magnesium euxanthinate,



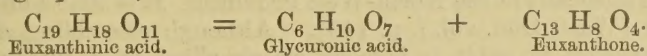
“ This formula corresponds to the following composition :—

Euxanthinic acid -	-	-	-	78·16
Magnesium -	-	-	-	4·57
Water -	-	-	-	16·67

“ Purified Indian Yellow therefore contains a little less organic and more inorganic matter than the pure salt.

“ The first scientific researches on Indian Yellow were published in 1844 by Stenhouse and Erdmann. Since that date it has been repeatedly studied. The result has been to establish for euxanthinic acid the formula  $\text{C}_{19} \text{H}_{18} \text{O}_{11}$ . The free acid has a pale yellow colour, but the salts are all tinged deep yellow, and it is the magnesium salt which is most remarkable for its fine colour.

“ In treating euxanthinic acid with weak acids or with water euxanthinic acid breaks up into two substances, of which one is colourless and the other coloured. The first has principally a physiological interest; it has received the name of glycuronic acid and forms one of a series of substances which appear in the urine of man and of the dog after the introduction into the stomach of various organic compounds, such as camphor and chloral. All the series are conjugated bodies which readily break up, setting glycuronic acid free, as shown by the following equation,



Glycuronic acid may be considered as a derivative of the group of sugars and as an oxidation product intermediate between glucose and saccharic acid. It has not at present been obtained artificially.

“ The coloured product arising from the decomposition is euxanthone, which belongs to the aromatic series. When euxanthone is given to a dog, as Kostanecki was the first to do, or to a rabbit according to the experiments of Kulz, it appears in the urine in the form of euxanthinic acid; in passing through the animals it combines with glycuronic acid. We may therefore conclude that mango leaves contain either euxanthone or a body capable of transformation in the organs of the cow into euxanthone, and this by combining with glycuronic acid produces the colouring matter. The magnesium which is an essential ingredient in Indian Yellow either comes from the food of the animal or from water, assuming, of course, that in the process of its preparation, the natives



do not add a salt of magnesia. This certainly does not seem likely, and the report makes no mention of it."

Prof. Græbe then enters into a description of the physical and chemical properties of euxanthone. He discusses its chemical constitution and indicates the method by which he has succeeded in artificially preparing it.

## CXXXV.—BOMBAY ALOE FIBRE.

(*Agave vivipara*, L.)

The high prices lately obtained for white rope fibres have stimulated their production in nearly every part of the world. The chief supplies of these fibres have hitherto been obtained from the Phillipines under the name of Manila hemp (yielded by *Musa textilis*), *Bulletin*, 1887, April, p. 1, and from Yucatan under the name of Sisal hemp (yielded by one or more varieties of *Agave rigida*), *Bulletin*, 1887, March, p. 3. Quite recently a fibre of a somewhat similar character made its appearance in this country under the name of "Bombay Aloe fibre." This was very imperfectly prepared, and the price obtained for it was exceptionally low. In fact, had it not been for the relatively large demand for white rope fibres during the last two years this Bombay Aloe fibre would be unsaleable at a price that would hardly cover the cost of freight.

A specimen of Bombay Aloe fibre was presented to the Museums of Economic Botany at Kew by Messrs. Ide and Christie in 1888, and this led to an inquiry respecting the plant yielding it. Application was made to the India Office to obtain specimens of the growing plants and for information respecting the methods adopted for preparing the fibre. By the action of the Secretary of State for India in Council, the plants and full particulars respecting the preparation of the fibre have now been received at Kew. It appears that Bombay Aloe fibre is prepared from the leaves of *Agave vivipara*, L. in a crude manner by natives, and so far no attempt has been made to establish regular plantations.

*Agave vivipara*, L. (Wight Icones, t. 2024; *A. cantula*, Roxburgh's Flora of India, vol. ii. p. 167), the "Bastard Aloe" of India, is a native of tropical America, but now found widely spread through various parts of the Old World. It is said to be commoner in Upper than in Lower India, and especially in the North-West Provinces. It is almost unknown in Bengal (Watt, Dict. vol. i. p. 143). Although resembling *A. americana* somewhat in habit, it is more closely allied to *A. lurida*. The dull green leaves are from 4 to 5 feet long, rather narrow and concave, thin but firm in texture, ending in a brown spine about half an inch long. The teeth are sub-distant, brown and hooked,  $\frac{1}{2}$  to 1 inch long. The flowers borne upon a tall branched flowering stem, about 20 feet or more in height, are greenish yellow. The specific name of the plant is derived from the fact that the flowers are often changed into bulbillæ; these grow into plants with leaves from 6 to 9 inches long before they fall and take root. "Royle states that on a rich soil the plant is viviparous, while on a poor stony soil and under a dry climate, seeds alone are produced."

The utilisation of *Agave vivipara* as a fibre plant on a large scale is apparently of a very recent date. Dr. Watt, in a notice of the species, does not refer to it as the origin of Bombay Aloe fibre, and apparently he was unacquainted with the fact. The only reference to the fibre is



as follows :—"The *Oudh Gazetteer* says it is chiefly grown as a hedge (plant) to keep back cattle, but in the jails good fibre is prepared from its leaves." *Dict. Econ. Prod. India*, vol. i. p. 143 (1887).

As already mentioned the Bombay Aloe fibre received in this country is so badly prepared that it is practically unsaleable. About 200 tons were received in 1889, and we are informed by Messrs. Ide and Christie that the stocks of former shipments have now accumulated to the extent of 1,000 tons. The prices quoted are, good 12*l.*, common 5*l.* per ton. As the result of investigations detailed in the following correspondence it appears that the fibre of *Agave vivipara*, though perhaps not so good in all respects as that derived from varieties of *Agave rigida*, is of considerable merit. If properly cleaned it would command relatively high prices. A specimen of fibre from *Agave vivipara*, cleaned in this country by the Death machine, has been valued at 25*l.* to 30*l.* per ton. The difference between 12*l.* and 30*l.* per ton, due entirely to the mode of cleaning this fibre, is a fact that needs no comment.

ROYAL GARDENS, KEW, to INDIA OFFICE.

Royal Gardens, Kew,

February 21, 1889.

SIR,

I AM desired by Mr. Thiselton Dyer to inform you that a specimen of white fibre, known in commerce as "Bombay Aloe fibre," has been lately presented to the Kew Museums of Economic Botany.

2. From the character of the fibre it would appear that this is obtained from *Agave americana* or an allied species, and rudely prepared by hand. The price of this fibre is from 15*s.* to 18*s.* per cwt., while Sisal hemp obtained from *Agave rigida* is selling at 52*s.* to 54*s.* per cwt.

3. It is very desirable to trace the source of this Bombay Aloe fibre. For this purpose it is necessary to obtain specimens of the plant yielding it.

4. Mr. Thiselton Dyer is of opinion that as the Bombay fibre industry is apparently an established branch of trade, its value might be greatly increased by the introduction of plants yielding the true Sisal hemp, and by improvements in the preparation. The subject is of considerable importance at the present time, as white fibres are in great demand and sell at high prices.

5. I am therefore to suggest that the Government of India should be moved to procure and forward to Kew specimens of leaves or small plants from which the present Bombay Aloe fibre is obtained, and full information as to the preparation and shipping of the fibre. On receipt of these Mr. Thiselton Dyer will be happy to furnish a report on the subject, which may assist the Government of India in developing what may prove an important native industry.

I am, &c.

(Signed) D. MORRIS.

J. A. Godley, Esq., C.B.

INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,

March 23, 1889.

SIR,

I AM directed by the Secretary of State for India in Council to acknowledge, with thanks, the receipt of your interesting letter of the 21st ultimo, on the subject of the true source of the "Bombay Aloe

fibre" of commerce, and to inform you in reply that a copy of the same has been forwarded to the Government of Bombay for their information and guidance.

The specimens and information for which you ask will at once be transmitted to you on receipt from Bombay.

The Director,  
Royal Gardens, Kew.

I am, &c.  
(Signed) J. A. GODLEY.

#### INDIA OFFICE TO ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,  
January 21, 1890.

SIR,

IN continuation of my letter of the 23rd March last, I am directed by the Secretary of State for India in Council to forward herewith a copy of a letter dated 13th December 1889, with its enclosure, from the Government of Bombay on the subject of the "Bombay Aloe fibre" of commerce.

The box of specimens referred to has been forwarded separately to your address by carrier.

I am, &c.  
(Signed) C. E. BERNARD,  
Secretary,  
Revenue and Statistics Department.

The Director,  
Royal Gardens, Kew.

#### [ENCLOSURE.]

ACCOMPANIMENT to the Bombay Government Despatch to Her Majesty's Secretary of State for India in Council, No. 52, dated 13th December 1889.

Report by the Officiating Director, Land Records and Agriculture, No. 2262, dated 23rd November 1889 :—

Undersigned has the honour to forward by rail a box containing six young shoots (useful for planting) and a full grown plant of *Agave vivipara*, the common species of *Agave* grown in the Bombay Presidency.

2. The Aloe fibre shipped under the name of "hemp" [or Aloe fibre] from Bombay comes chiefly from the Bombay Karnatak and the Central Provinces. It is not possible to ascertain from the trade returns details of the export trade in the Aloe fibre.

3. The Bombay Aloe fibre is prepared from *Agave vivipara*, *Agave Americana* being rare. The plant grows wild, but nowhere in abundance. Nor is it anywhere cultivated specially for extracting fibre. It is chiefly used as a hedge plant in making live fences. As a hedge plant it is preferred to Cactus [*Opuntia*] and Milk-bush [*Euphorbia*]; and though it requires a greater breadth than other hedge plants, it is reported to be not injurious to plants in the vicinity. It grows well near watercourses, and this habit of the plant is put to profitable account by using it for live fences along boundaries of survey numbers which are subject to a rush of water. In such places it is planted close with a view to allow water only to pass through the fence and retain silt. When planted sufficiently close it serves as a dam and prevents entrance of rain-water of neighbouring fields. In the Bombay Karnatak it is the chief hedge plant along railway lines. For fencing it is planted 1 to 3 feet apart according to the quality of the soil.



4. It is a plant of slow growth, and takes about two years before the leaf can be cut for fibre. Its slow growth is one of the drawbacks which prevent the plant from being cultivated for fibre. The leaves are cut from the stem and split lengthwise into thin shreds about half an inch wide, and bound in sheaves. In some places before they are bundled the shreds are dried in the sun for about four days. The sheaves are then kept soaking in a running brook, under a weight, for a week or ten days and sometimes more, or buried in sand near the current of water in stream and river beds wherein water percolates. When sufficiently decomposed, the leaves are taken out and washed clean of the pulp by beating them in running water with wooden mallets, or against a stone. After washing, what remains is fibre. In Bijápúr the fibre is sometimes separated by drying the leaves and beating them with wooden mallets.

5. Much of the fibre is made into ropes, which are chiefly used in agricultural operations. The manufacture is in the hands of Māngs and other depressed castes, who make ropes of hemp, coir, &c. Kimbis or cultivators seldom take to rope making. In the Karnátak, Advichinchers, a wandering tribe, have of late taken to rope making.

ROYAL GARDENS, KEW, to INDIA OFFICE.

Royal Gardens, Kew,  
February 14, 1890.

SIR,

WITH reference to my letter of the 21st February 1889, and subsequent correspondence on the subject of Bombay Aloe fibre, I am desired by Mr. Thiselton Dyer to inform you that the specimens of plants from India, advised in your letter of the 21st ultimo, have been duly received at Kew.

2. These specimens confirm the fact that the Bombay Aloe fibre of commerce is prepared from the leaves of *Agave vivipara*, L., an American species of *Agave* now widely distributed throughout sub-tropical and tropical parts of the Old World and some parts of India. From the interesting report of the Officiating Director of Land Records and Agriculture (Bombay), we gather that the fibre is extracted by certain depressed castes of natives by very crude and destructive methods, and that so far no attempt has been made to cultivate the plants. They are chiefly used as hedge plants, and are "nowhere at present in abundance."

3. It is evident, however, that the plants exist in Bombay in sufficient quantity to supply several hundred tons of fibre received in this country. After a consideration of the facts noted below, it might be found advisable to cultivate this species of *Agave* on waste lands in Bombay entirely for the sake of its fibre; or the Sisal hemp plant, *Agave rigida*, var. *Sisalana* might be introduced on a large scale. This latter yields the most valuable fibre of any derived from species of *Agave*, and there is little doubt it would thrive equally well in India. The important fibre industry of Yucatan, created entirely within the last 20 years, is now of the annual value of about three-quarters of a million sterling. India has, therefore, good grounds for devoting attention to an industry which so far has established itself on a moderate scale in spite of adverse circumstances.

4. In order to test the quality of the fibre produced by *Agave vivipara* when cleaned by machines similar to those in use for the preparation of Sisal hemp in Yucatan and the West Indies, a few of the broken leaves about a foot to two feet in length, taken from the larger plant received



at Kew, were forwarded to the Death's Fibre Machine Company, 147, Leadenhall Street, E.C. A sample of the fibre obtained by passing the leaves through the Death machine is forwarded herewith (marked A); while, for purposes of comparison, a sample of the ordinary Bombay Aloe fibre, as it comes into the London market direct from India, is also enclosed (marked B).

5. The great difference in quality and value between these two samples are well given in a report prepared by Messrs. Ide and Christie, a copy of which is herewith attached. The value of the machine-cleaned fibre ranges, according to length, from 25*l.* to 30*l.* per ton. The ordinary Bombay Aloe fibre, cleaned by hand, is worth only from 5*l.* to 12*l.* per ton. These figures fully bear out the opinion offered in my letter of the 21st February 1887, that the Bombay Aloe fibre industry was capable of being greatly improved. At the present time there are in stock in this country 1,000 tons of Bombay Aloe fibre, which, prepared roughly by hand, will only realise (if sold) about 8,000*l.*, a price that will probably hardly pay expenses. If this fibre had been cleaned by machinery, and presented in the condition of the sample marked A, it would realise about 27,000*l.*, or more than three times its present value. It appears possible, therefore, without any extension of the present *Agave* plants in Bombay, to increase to a very appreciable extent the returns on the shipment of Aloe fibre from that Presidency.

6. Mr. Thiselton Dyer has little doubt that the facts herein stated will prove of considerable interest to the Government of India, and they deserve to be widely known amongst those concerned in the Bombay Aloe fibre industry.

J. A. Godley, Esq., C.B.

I am, &c.  
(Signed) D. MORRIS.

[ENCLOSURE.]

MESSRS. IDE AND CHRISTIE to ROYAL GARDENS, KEW.

DEAR SIR,

72, Mark Lane, E.C., February 6, 1890.

WE have your favour of the 4th instant with samples of fibre extracted by Death's process from the leaves of *Agave vivipara*. This is an excellent fibre, of fair strength, fine colour (which, however, may change somewhat under continued exposure to the air), and were it *three* times as long would be worth 30*l.* per ton to-day in London; if *twice* as long 27*l.*; and, as it is, it may be valued at 25*l.*

The ordinary "Bombay Aloe" of commerce presents a very different appearance to your specimen, as, perhaps, samples in your Museum may show. Its value to-day is, *good* 12*l.*, *common* 5*l.* per ton.

Yours, &c.

D. Morris, Esq., M.A., F.L.S.

(Signed) IDE AND CHRISTIE.

## CXXXVI.—COMMERCIAL VALUE OF LOXA BARK.

(*Cinchona officinalis*, L.)

The note on the commercial value of cinchona bark in the Bulletin for October 1889 was the subject of the following remarks in the journal of the Pharmaceutical Society for November 2, 1889, p. 343:—

"In a note in the *Kew Bulletin* (October, p. 247), relating to cultivated Jamaica cinchona bark, some correspondence on the subject



of cinchona is published which discloses the curious fact that fine old silvery loxa bark of the H.O. brand is about twelve times as valuable as Jamaica bark, not on account of its larger per-centage of alkaloid but because it is used to give a peculiar bouquet to the tonic wine of Cinchona that is sold largely in France. It would be interesting to know how far the aroma is due to the lichens on the bark, and how much may be due to the flavour of the bark itself, which in some varieties, as in *C. micrantha*, is strongly marked."

The suggestion that the aroma is due to the lichens is ingenious and not impossible. The following further correspondence would, however, appear to show that nothing more than custom is at the bottom of the preference of native Loxa bark for that of even better intrinsic quality grown elsewhere.

DAVID HOWARD, Esq., F.C.S. to ROYAL GARDENS, KEW.

Stratford, near London, E.,

November 21, 1889.

MY DEAR SIR,

I HAVE been endeavouring to get accurate information about the properties for which American Loxa bark is valued at so disproportionate a rate, but can get no further than the information of experts that it must be exactly what the foreign druggists are used to. As far as I can tell chemically the Jamaica bark is superior to the Loxa, the alkaloidal content being higher, the South American Loxa giving 1.95 of sulphate of quinine and no cinchonidine, equalling 1.46 per cent. of quinine alkaloid.

There is a very slight difference in the smell and in the taste of the infusion, the Loxa bark having a less refined taste.

At the same time I have no doubt the experts are right as to the mercantile question; as an example how little real value governs price, the thick red bark, evidently from very old trees, which comes in very small quantity from South America, sells at 8s. to 9s. per pound, though what quinine it ever contained has entirely changed into rouge cinchonique, and the sole virtue of the bark is its fine red colour.

The present value of the Jamaica samples to quinine manufacturers would be from 5d. to 6d. per pound.

I am, &c.

(Signed) DAVID HOWARD.

D. Morris, Esq., M.A., F.L.S.

[Enclosure No. 1.]

MESSRS. WRIGHT, LAYMAN, & UMNEY to MESSRS. HOWARD  
& SON.

50, Southwark Street, London, S.E.,

November 5, 1889.

DEAR SIRS,

Cinchona officinalis, Jamaica.

I AM of opinion that this bark would not be substituted in Pharmacy for Loxa bark, notwithstanding alkaloidal tests might be identical, unless the bark itself was very slightly and closely resembled Loxa in appearance.

Yours, &c.

(Signed) CHAS. UMNEY.

Messrs. Howard and Son.

## [ENCLOSURE No. 2.]

Messrs. JENKIN &amp; PHILLIPS to Messrs. HOWARD &amp; SONS.

21, Mincing Lane, London, E.C.,

November 20, 1889.

GENTLEMEN,

WE have examined the two samples of Jamaica Cinchona officinalis, and we are of an opinion that it would in nowise be bought and used for the same purposes as South American Loxa bark, the chief market for which is Paris, and where, if it is fine, they will pay a long price for it.

The appearance, flavour, and aroma of your samples are quite distinct from South American Loxa.

If your friends sent their bark over in long, even, unbroken quills, it would fetch at the moment 6*d.* to 7*d.* per pound.

We are, &amp;c.

Messrs. Howard &amp; Sons.

(Signed) JENKIN &amp; PHILLIPS.

## CXXXVII.—BARILLA.

*(Halogeton sativus, Moq.)*

Carbonate of soda is one of the most indispensable of substances in the manufacturing arts. It is essential, for example, in glass and soap-making. Since the end of the last century it has been manufactured directly on a continually increasing scale from common salt (sodium chloride). Before this, most of the carbonate of soda in use was obtained by burning marine plants, which in their turn obtained it indirectly from sea-water.

The two kinds of impure sodium carbonate, which were formerly met with in commerce, were known as kelp and barilla. The former was obtained by burning sea-weeds; the latter by burning various kinds of land-plants which grew in salt-marshes, and the representatives of which in this country were collectively known as salt-worts.

It is a well-ascertained fact that in the ash of inland plants soda is only found in very trifling amounts. Its function is therefore altogether different to that of potash, which is an indispensable ingredient of pearl food. Nevertheless, plants which are periodically moistened with sea-water, accumulate relatively large quantities of soda salts in their tissues. But their presence, as far as the nutrition of the plants is concerned, must be deemed to be wholly accidental.

The principal seat of the Barilla industry was Spain and the Balearic Islands; but the Canary Islands, Italy, and France are said also to have contributed a part of the production. It appears now to be almost obsolete, but to still linger in the neighbourhood of Alicante. The Egyptian Government seem disposed to attempt it experimentally in some part of the Nile delta, and has recently asked for a supply of seed.

ADMINISTRATION DES DOMAINES DE L'ETAT EGYPTIEN to ROYAL  
GARDENS, KEW.

SIR,

Cairo, 7th January 1890.

I HAVE the honour to inform you that at the request of Sir Evelyn Baring, Her Britannic Majesty's Agent and Consul-General in Egypt, Mr. Gibson, British Commissioner of the Egyptian State Domains, supplied for Kew Gardens about 50 lbs. of cotton seed.



Mr. Gibson, instead of charging you anything for this seed, will feel obliged if you will send him a small quantity, viz., 2 lbs. or 3 lbs., of the seed of *Salsola sativa* (Halogeton sativus) (Barilla) in exchange.

I have, &c.

(Signed) W. WILFRED CAREY,  
Inspector of the States Domains.

W. T. Thiselton Dyer, Esq.,  
C.M.G., F.R.S.

The whole question was, however, carefully gone into five years ago, when, as will be seen from the following correspondence, exhaustive information was obtained on the actual state of the existing Barilla industry, and a supply of seed of the Barilla plant was sent to the Egyptian Government.

#### ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew,  
25th January 1884.

SIR,

I AM desired by Sir Joseph Hooker to inform you that inquiries have been made of this establishment on behalf of the Director-General of the Revenue in Egypt, on the subject of the mode of cultivating plants which produce Barilla. It is thought that this industry might be attempted in the Egyptian delta with success.

Like the kelp industry of the British Isles the preparation of Barilla has, apparently, to a large extent become obsolete owing to the development of the manufacture of soda salts by purely chemical processes from common salt in Great Britain and elsewhere. It is probable, however, that the manufacture of Barilla still to some extent exists in Spain. Very little is known as to the details of the industry, which is said to be more particularly carried on in the neighbourhood of Alicante. It is possible that in Egypt and other countries, with exceptional local conditions, the manufacture of Barilla might still be carried on with profit. Sir Joseph Hooker would therefore wish to submit to the Secretary of State that it might be useful if Her Majesty's Vice-Consul at Alicante would prepare a report upon the present state of the Barilla industry. At the same time I am to ask that authentic samples of Spanish Barilla (a few pounds would suffice) may be obtained for the Museum of the Royal Gardens, as well as of the plants used in its manufacture in the dried state before they are reduced to ash.

I have, &c.

(Signed) W. T. THISELTON DYER.

T. Villiers Lister, Esq.

#### FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR,

Foreign Office, 26th February 1884.

I AM directed by the Secretary of State for Foreign Affairs to transmit to you, to be laid before Sir Joseph Hooker, with reference to your letter of the 25th ultimo, a despatch from Her Majesty's Consul at Barcelona, enclosing a report by the British Vice-Consul at Alicante on the production of Barilla, and reporting that he has instructed Mr. Cumming to send home a sample of this plant.

I am, &c.

(Signed) T. V. LISTER.

W. T. Thiselton Dyer, Esq., C.M.G.

## [Enclosure No. 1.]

BRITISH CONSULATE, CATALONIA, to FOREIGN OFFICE.

MY LORD,

Barcelona, 21st February 1884.

HAVING immediately requested Mr. Vice-Consul Cumming, of Alicante, to comply with the instructions conveyed to me in Despatch No. 1, Commercial, of the 31st January last from the Foreign Office, on the subject of Barilla and its industry, he has sent me the enclosed report, which I forward in original, having further directed him to transmit to London, addressed to Sir Joseph Hooker, Director of the Royal Gardens, Kew, the small box he has prepared with samples of plant, seed, and ashes.

I have, &amp;c.

The Right Hon.

Earl Granville, K.G., &amp;c., &amp;c.

(Signed) JOHN TRAT,  
Consul.

## [Enclosure No. 2.]

## REPORT on the BARILLA INDUSTRY.

Since the development of the manufacture of soda salts by purely chemical processes, the Barilla industry in this province has become very reduced, although not completely obsolete, the plant being still cultivated to a certain extent. It is very difficult to ascertain the quantity of Barilla manufactured, but I am informed that from 200 to 250 tons may be considered an average yearly production. Value varies greatly according to abundance and demand, and may be roughly quoted from \$2 to \$2½ per quintal or 50 kilos.

As to the cultivation of the plant, the seed is sown in January and February in the same manner as other ordinary seeds and requires no special care. The seed becomes worthless if not sown the season following its collection. The plant is gathered in August. It is pulled up by the root, spread for two or three days, and then collected in small conical shaped cocks or piles of two or three quintals each, so that in case of rain the water may not penetrate so much into the interior and rot the plant. It is left thus about a month to thoroughly dry. If not then required to be burnt it is stacked and covered with esparto or rush to preserve it.

The manufacture of Barilla is carried out as follows:—A hole is dug out in the form of a large round earthenware pot, about 1½ feet in diameter at the mouth, about 4 feet at bottom, and depth about 3½ feet, the inner part of which is well beaten and then covered with a slight smooth coating of mud. A small quantity of wood is then burnt to ashes in this hole to dry and heat it, when it is cleaned out and a couple of iron rods or bars are placed across the mouth, over which bars a quantity of the plant is placed and fired, more being added continually as it is consumed, for about 12 hours. Then the bars are removed by means of a large, bent, two pronged, wooden fork, the boiling substance in the hole is thoroughly stirred, till it becomes even and smooth on surface like molten lead; then the bars are replaced, and the same operation repeated until the hole is filled, when the entire mass is finally stirred as described. The mouth of the hole is then closed up, and the Barilla is left about a week to cool thoroughly, during which time it hardens and cracks into pieces. The hole has then merely to be dug around and the Barilla taken out.

(Signed)

JASPER W. CUMMING,  
Vice-Consul.

Alicante, 18th February 1884.



## ROYAL GARDENS, KEW, to INDIA OFFICE.

Royal Gardens, Kew,  
14th March 1884.

SIR,

I AM desired by Sir Joseph Hooker to transmit to you the enclosed copies of correspondence with the Foreign Office, on the subject of the manufacture of Barilla. A similar industry exists in several parts of India. In Scinde, a product known as Kharsuji is said to be made and used for the manufacture of soap and glass. Sir Joseph Hooker thinks it possible that the systematic preparation of Barilla might be usefully prosecuted on the saline soils of many parts of N.W. India.

I am, &amp;c.

(Signed) W. T. THISELTON DYER.

J. A. Godley, Esq., C.B.

## ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew.  
31st March 1884.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of February 26, enclosing a despatch from Her Majesty's Consul at Barcelona, transmitting a report from the British Vice-Consul at Alicante, on the production of Barilla. Sir Joseph Hooker has read this with much interest, and has further to express his thanks for the very satisfactory specimens which have also recently come to hand from Mr. Jaspas W. Cumming. A copy of his very excellent report has been furnished for the information of the Director-General of Revenue in Egypt with a portion of the seed. Other portions will be transmitted to Jamaica, N.W. India, and the Cape, in all of which places, local circumstances might be favourable to the Barilla industry finding a footing.

I am, &amp;c.

(Signed) W. T. THISELTON DYER.

T. V. Lister, Esq.

## INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, S.W.,  
4th April 1884.

SIR,

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letter of the 14th ultimo, with enclosure, on the subject of the manufacture of Barilla in Spain, and to inform you, in reply, that a copy of the same has been forwarded to the Government of India for such action thereon as they may think desirable.

I have, &amp;c.

(Signed) J. A. GODLEY.

The Director, Royal Gardens, Kew.

## INDIA OFFICE to ROYAL GARDENS, KEW.

India Office, S.W.,  
13th August 1885.

SIR,

WITH reference to my letter of 4th April 1884, I am directed by the Secretary of State for India in Council to forward to you, the accompanying copy of a report by Mr. George Watt, M.B., on special

duty with the Indian Revenue and Agricultural Department, on the present state of the Barilla industry in India.

The report has been prepared by Mr. Watt from the answers to a circular inquiry founded on your letter of 14th March 1884, which was addressed by the Government of India to all the Indian Provincial Governments.

I have, &c.  
(Signed) J. A. GODLEY.

Sir Joseph Hooker, K.C.S.I.,  
&c.                      &c.                      &c.

#### BARILLA.

Khár-sajjī or Sajjī-khár, or Barilla. This is carbonate of soda obtained from the ashes (*khár*) of certain salt-worts . . . . The manufacture of Barilla first assumed commercial importance in Spain, and was an article of considerable value until Le Blanc discovered his method of preparing soda from common salt. Since then it has considerably declined. Before this important discovery the demand for Barilla caused attention to be directed to India as a country to which the trade might possibly be extended. Roxburgh, at the beginning of the century, recommended the cultivation of one or two plants on the coast of Madras, but there is no evidence of this having been acted upon.

Mr. Baden Powell (in his *Panjab Products*, Vol. 1., 86) has given a most instructive account of Barilla manufacture as practised in the Panjáb. The process by which this substance is prepared is carried on during the month of October and the three following months. The plant after being cut down is allowed to dry. The next step is to dig a pit of a hemispherical shape, about 6 feet in circumference, and 3 feet deep. One or more vessels with holes perforated are inverted and placed in the bottom of the pit, the holes being kept closed when the operation begins. The dry plants are gradually burned, and during the process a liquid substance is found to run down into the inverted vessels. After this has taken place, the residue is stirred up by means of a flat piece of wood and kept covered over for three or four days till it cools. Care must be taken not to allow water to get to the molten liquid, otherwise the whole mass would blow up. In the inverted vessels will be found a pure form of *hhár-sajjī*, and in the bottom of the pit an impure form containing a mixture of ashes. The process differs only very slightly from that followed in Spain. In the latter country the plants are burned on iron bars placed across the mouth of the pit, and vessels to separate the substance into pure and impure Barilla are not placed in the bottom.

. . . . . In Shahpur and Multan, however, the manufacture of *sajjī* is considerable. The Deputy Commissioner of Shahpur reports that the outturn is from 8,000 to 10,000 maunds a year, and the revenue derived by Government by the lease of the *sajjī* producing lands amounts at present to over Rs. 9,500 per annum. The price, too, from various causes has risen from Rs. 1-2 to about Rs. 1-10 per maund since 1865.

. . . . . The Deputy Commissioner of Multan says that in his district the plants are cut in the months of January and February, and not in October and November as stated in Baden Powell's *Panjab Products*. He adds, "I can find no evidence that the introduction of "soda salts manufactured by purely chemical processes has injuriously



"affected the trade in Barilla." He adds that the land on which Barilla yielding plants grow was leased for 1883-84, and realised "Rs. 7,907, which is higher than that realised in any of the past 10 years, except 1875-76, 1877-78, 1878-79, and 1879-80."

The Settlement Report of Shahpur district contains an interesting account of *sajji* manufacture. The Deputy Commissioner says, in reference to Colonel Davis' report: "The account of *sajji* manufacture given by Colonel Davis in 1865 seems to contain all the information required, and this industry is now in about precisely the same condition as it was then. As far as I have been able to ascertain, the introduction of soda salts manufactured by purely chemical processes has not affected it at all injuriously. On the contrary, the price of *sajji* has lately risen to Rs. 1-8 and Rs. 1-12 per maund, but this is said to be chiefly due to the fact that owing to recent droughts the growth of the plants has been less flourishing than formerly. The sums realised from farming the monopoly of manufacturing this alkali amount still to upwards of Rs. 8,000. The income under the head *sajji* last year was a little over Rs. 9,500. The quantity of *sajji* manufactured in this district is said to be about 10,000 maunds, but the plant itself is also highly esteemed as a fodder for camels, and the farmers of *sajji* do not allow camel owners to take the plant for fodder gratis."

The following extracts from the Settlement Reports of Jhang and Montgomery might also be here given. "*Caroxylon Griffithii* is the *khár*. There is a considerable disagreement as to what plant or plants *sajji* is made from. In the Jhang district *sajji* is made from *khár* only. I have made repeated inquiries and have always received the same answer, that *sajji* is made from *khár*, but that sometimes . . . the bulk of the *sajji* is increased by burning *lana* with the *khár*. I have been constantly in camp at the time the *khár* is cut, but I have never seen a single bundle of cut *lana*, and such adulteration is very uncommon. All four plants are excellent grazing for camels."

In Montgomery "a good deal of misapprehension seems to exist about the *lana* plant. There are three kinds of *lana*; *Khangán khár* (*Caroxylon Griffithii*); *Góra lana*; and *Methar lana* (*Salsolas*). There is also a plant called *Phesak lani* (*Suæda nudiflora*). *Sajji* (barilla), an impure carbonate of soda, is made from the first two. No *sajji* is made from the others. The best *sajji*, called *Lóta sajji* is made from *Khangán khár*; an inferior quality, known as *Bhútni sajji*, from *Góra lana*. All four plants can be seen in the Montgomery civil station."

The Commissioner of Sind reports that there are no soda salts manufactured by purely chemical processes in Sind, but that there is a substance called *khár*, manufactured from a plant called "*lani*," which grows wild all over the province, and springs up spontaneously after a copious fall of rain. The *khár* or salt obtained from this plant is commonly used in Sind for dyeing, washing, and soap-making purposes, and in the manufacture of common glass. The Commissioner gives the following account of the process adopted in manufacturing this salt from the "*lani*" plant, which, it will be observed, is very similar to that pursued in Spain: "The *lani* plant is cut and gathered together in heaps. A circular pit varying from one and a half to two or three feet in depth and diameter, according to the convenience of the individual manufacturer and the quantity to be manufactured, is then dug in a clean level piece of ground. A fire is kindled near the pit,



“ and the freshly-cut plant thrown on it. The action of the fire causes  
 “ the juice of the plant to exude and run into the pit. Fresh quantities  
 “ of the plant are thrown on the fire from time to time, until the pit is  
 “ almost filled with the liquid exudation. The mass is then stirred with  
 “ a pole for from two to three hours, after which the pit is covered over,  
 “ and on the third day, when the liquid has cooled down and solidified,  
 “ it is dug out and broken into pieces for use.”

Mr. Erskine adds that the manufacture flourishes most near Kutchee in Khelat, about 5,500 maunds of *khár* being annually imported in Jacobabad; that the quantity manufactured in Shikárpur, and in Thar and Párkár, is roughly estimated at 5,500 maunds and 3,000 maunds respectively every year; that the demand for the article has not been affected by the manufacture of soda salts by chemical processes, and that its price varies between R. 1 and annas 8 a maund. The Political Resident at Aden reports that *Salsola* (*Suæda nudiflora*), vulgarly called “Aden Balsam,” grows freely in the plain in the neighbourhood of Aden, and that before the purchase of Shekh Othman, large quantities of the bush were wastefully burnt to produce salt, but that the shrub is now preserved within British limits. He observes that the bush seems to possess great vitality and fecundity; that it is termed by the Arabs “*asl*,” and the Barilla made therefrom is named “*hotmi*”; that the Indians style it indifferently *khár*, *khár-sají*, and *sají-khár*; that the method of manufacture is primitive, and resembles that described in the correspondence accompanying the letter from the Government of India, except that iron rods are not placed over the holes wherein the plant is consumed, and that advantage will be taken of the Spanish method in working the industry, which it is proposed to do shortly under Government supervision. Major Hunter adds, “Soda salts manufactured  
 “ by purely chemical processes are only imported into Aden to the  
 “ extent of ten or twelve hundredweights per annum, and do not  
 “ affect the local manufacture in any way. In Aden Barilla is pro-  
 “ duced in circular cakes, having a diameter of about eighteen inches,  
 “ and a maximum thickness of eight inches. The value may be  
 “ roughly quoted at from five to eight annas per twenty-eight pounds.  
 “ It is anticipated that a certain amount of profit will be gained by the  
 “ municipality to whom the bushes belong, either by the manufacture  
 “ of Barilla under supervision, or by the sale of the right to produce it.”

The following are Indian plants reported to yield barilla :—

1. *Anthrocnemum indicum*, Moq., Coromandel Coast.
2. *Caroxylon fetidum*, Moq., Sind and Panjáb.
3. *Caroxylon Griffithii*, Moq. Regarded as one of the best plants in the Panjáb.
4. *Salicornia brachiata*, Roxb., Sunderbuns and Coromandel.
5. *Salsola brachiata*, Pall., Afghanistan.
6. *Salsola Kali*, Willd., Sind and Panjáb.
7. *Suæda fruticosa*, Forsk., Sind and Panjáb and Malabar Coast.
8. *Suæda indica*, Moq., Sunderbuns and Coromandel.
9. *Suæda nudiflora*, Moq., Aden, Pondicherry.